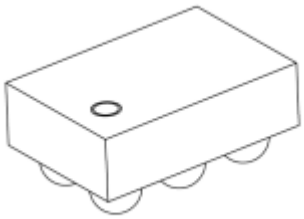
TOSHIBA CMOS Linear Integrated Circuit Silicon Monolithic

TCK22xxxG, TCK2065G, TCK1024G

Load Switch IC with Over current limited function

The TCK22xxxG, TCK2065G and TCK1024G are Load Switch ICs for power management with Over Current Limited function featuring low switch on resistance, ultra low quiescent current, high output current and wide input voltage operation. Typical switch ON resistance is only 31 mΩ at V_{IN} = 5.0 V, I_{OUT} = -0.15 A load conditions. And these feature a thermal shut down function and output auto-discharge function.

These devices are available in 0.4 mm pitch ultra small package WCSP6E (0.8 mm x 1.2 mm, t: 0.55 mm). So these devices are ideal for portable applications that require high-density board assembly such as cellular phone.



WCSP6E

Weight: 1 mg (typ.)

Feature

- Over current limit function
  I_{CL} = 400/740/1110/1540 mA (Option)
- Thermal shutdown function
- Inrush current reduction
- Output auto-discharge function
- True reverse current blocking function(Option)
- Under voltage lockout function(Option)
- Low ON resistance :
  R_{ON} = 31 mΩ (typ.) at V_{IN} = 5.0 V, I_{OUT} = -0.15 A
  R_{ON} = 40 mΩ (typ.) at V_{IN} = 3.3 V, I_{OUT} = -0.15 A
  R_{ON} = 70 mΩ (typ.) at V_{IN} = 1.8 V, I_{OUT} = -0.15 A
- Low quiescent current: I_Q = 25 μA (typ.) at V_{IN} = 5.5 V, I_{OUT} = 0 mA
- Pull down connection between CONTROL and GND
- Ultra small package : WCSP6E (0.8 mm x 1.2 mm, t: 0.55 mm)

Start of commercial production
2016-02

Function Table

Part number	Function						Device Marking
	Output current limit	True Reverse current blocking	Output auto-discharge	Under voltage lock out	Thermal shut down	Control pin polarity	
TCK22946G	400 mA	Built in	Built in	Built in	Built in	Active High	1T
TCK22951G	740 mA	Built in	Built in	Built in	Built in	Active High	2T
TCK2065G	1110 mA	Built in	Built in	Built in	Built in	Active High	3T
TCK1024G	1540 mA	Built in	Built in	Built in	Built in	Active High	4T
TCK22891G	400 mA	N/A	Built in	N/A	Built in	Active High	5T
TCK22892G	740 mA	N/A	Built in	N/A	Built in	Active High	6T
TCK22893G	1110 mA	N/A	Built in	N/A	Built in	Active High	7T
TCK22894G	1540 mA	N/A	Built in	N/A	Built in	Active High	8T

Absolute Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Input voltage	V_{IN}	-0.3 to 6.0	V
Control voltage	V_{CT}	-0.3 to 6.0	V
Output voltage	V_{OUT}	-0.3 to 6.0	V
Output current	I_{OUT}	Internally limited	-
Power dissipation	P_D	800 (Note 1)	mW
Operating temperature range	T_{opr}	−40 to 85	°C
Junction temeperature	Tj	150	°C
Storage temperature	T_{stg}	−55 to 150	°C

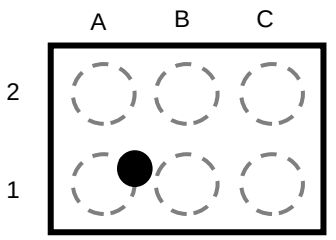
Note : Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings. Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook (“Handling Precautions”/“Derating Concept and Methods”) and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note1: Rating at mounting on a board
Board material: Glass epoxy (FR4)
Board dimension: 40mm x 40mm (both sides of board), t=1.6mm
Metal pattern ratio: a surface approximately 50%, the reverse side approximately 50%
Through hole: diameter 0.5mm x 28

Operating conditions

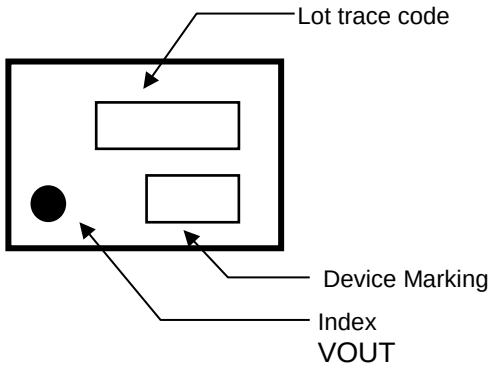
Characteristics	Symbol	Condition		Min	Max	Unit
Input voltage	V_{IN}	TCK22946G TCK22891G	—	1.1	5.5	V
		Others	—	1.4	5.5	
Output voltage	V_{OUT}	—		—	V_{IN}	V
CONTROL High-level input voltage	V_{IH}	1.2V < V_{IN} ≤ 5.5 V		1.0	—	V
		1.1V ≤V_{IN} ≤1.2 V		0.9	—	
CONTROL Low-level input voltage	V_{IL}	—		—	0.4	V

Pin Assignment(Top view)

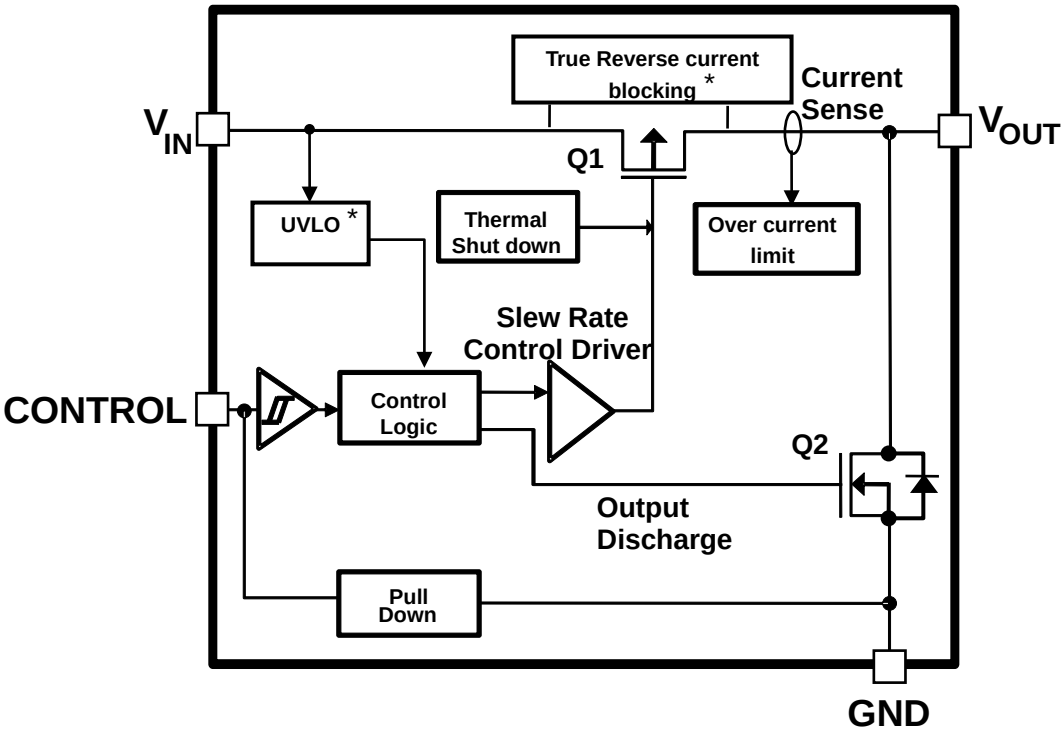


A1: V_{OUT}
B1: V_{OUT}
C1: GND
A2: V_{IN}
B2: V_{IN}
C2: CONTROL

Top marking



Block Diagram



*:Option

Operation logic table

		TCK22946G TCK22951G TCK2065G TCK1024G	TCK22891G TCK22892G TCK22893G TCK22894G
Control “High”	Output Q_1	ON	ON
	Discharge Q_2	OFF	OFF
	Reverse current blocking	Active	—
Control “Low”	Output Q_1	OFF	OFF
	Discharge Q_2	ON	ON
	Reverse current blocking	Active	—

Electrical Characteristics

DC Characteristics (Ta = -40 to 85°C)

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = −40 to 85°C		Unit
				Min	Typ.	Max	Min	Max	
Quiescent current (ON state)	I_Q	I_{OUT} = 0 mA	V_{IN} = 1.1 V	—	16	—	—	—	μA
			V_{IN} = 5.5 V	—	25	—	—	50	μA
Quiescent current (OFF state)	$I_{Q(OFF)}$	V_{IN} = 5.5 V, V_{OUT} = OPEN,		—	0.6	—	—	2.5	μA
Reverse blocking current	I_{RB}	V_{OUT} = 5.0 V, V_{IN} = 0 V, RCB active (Note 2)		—	0.01	—	—	2	μA
Reverse blocking voltage threshold	V_{RB}	$V_{OUT} – V_{IN}$ (Note 2)		—	35	—	—	—	mV
Reverse blocking release voltage threshold	V_{RBR}	$V_{OUT} – V_{IN}$ (Note 2)		—	-15	—	—	—	mV
Under Voltage Lock Out (UVLO) rising threshold	V_{UVL_RI}	— (Note 2)		—	0.82	—	—	1.1	V
Under Voltage Lock Out (UVLO) falling threshold	V_{UVL_FA}	— (Note 2)		—	0.77	—	—	—	V
On resistance	R_{ON}	I_{OUT} = -0.15 A	V_{IN} = 5.0 V	—	31	—	—	85	mΩ
			V_{IN} = 3.3 V	—	40	—	—	95	
			V_{IN} = 1.8 V	—	70	—	—	140	
			V_{IN} = 1.2 V (Note 3)	—	141	—	—	—	
			V_{IN} = 1.1 V (Note 3)	—	179	—	—	—	
Output Limited Current	I_{CL}	V_{IN} = 5.5 V	TCK22946G TCK22891G	—	400	—	—	—	mA
			TCK22951G TCK22892G	—	740	—	—	—	
			TCK2065G TCK22893G	—	1110	—	—	—	
			TCK1024G TCK22894G	—	1540	—	—	—	
Output discharge on resistance	R_{SD}	—		—	100	—	—	—	Ω

Note 2: Only applies to the TCK22946G, TCK22951G, TCK2065G and TCK1024G
Note 3: Only applies to the TCK22946G and TCK22891G

AC Characteristics (Ta = 25°C)

V_{IN} = 5.0 V

Characteristics	Symbol	Test Condition(Figure 1)	Min	Typ.	Max	Unit
V_{OUT} rise time	t_r	V_{IN}= 5.0 V , R_L = 500 Ω , C_L=0.1 μF,	—	50	—	μs
V_{OUT} fall time	t_f	V_{IN}= 5.0 V , R_L = 500 Ω , C_L=0.1 μF,	—	50	—	μs
Turn on delay	t_{ON}	V_{IN}= 5.0 V , R_L = 500 Ω , C_L=0.1 μF,	—	40	—	μs
Turn off delay	t_{OFF}	V_{IN}= 5.0 V , R_L = 500 Ω , C_L=0.1 μF,	—	10	—	μs

AC Waveform

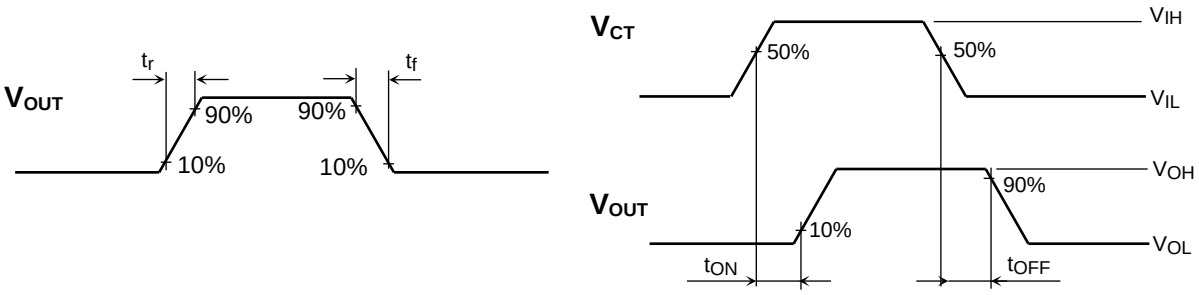
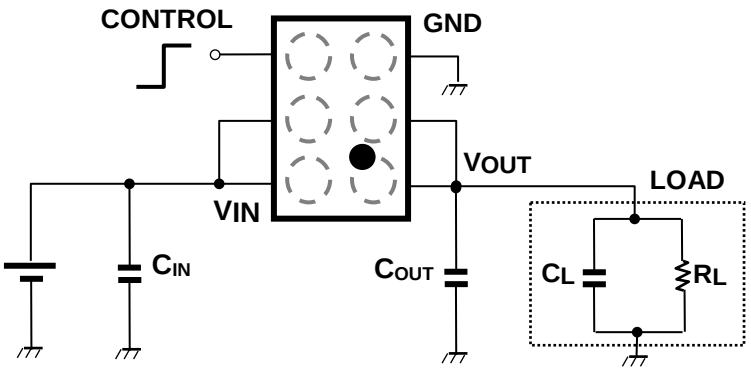


Figure 1 t_r, t_f, t_{ON}, t_{OFF} Waveforms

Application Note

1. Application circuit example (top view)

The figure below shows the recommended configuration.



Control Voltage	Output Voltage
HIGH	ON
LOW	OFF
OPEN	OFF

1) Input and Output capacitor

An input capacitor (C_{IN}) and an output capacitor (C_{OUT}) are necessary for the stable operation. And they are effective to reduce voltage overshoot or undershoot due to sharp changes in output current and also for improved stability of the power supply. When used, place C_{IN} and C_{OUT} more than 1.0μF as close to V_{IN} pin to improve stability of the power supply.

2) Control pin

The CONTROL pin controls state of the switch, operated by the control voltage and Schmitt trigger. Also, pull down resistance equivalent to a few MΩ is connected between CONTROL and GND, thus the load switch IC is in OFF state even when CONTROL pin is OPEN.

2. Over current limit function

This device has a built-in fold-back type of Current-limiting Circuit. Around 15% or more derating against typical values is recommended for system design with enough margin.

3. Thermal shutdown function

Each device has a built-in Thermal shutdown circuit. If the junction temperature goes beyond 170°C (Typ.), thermal shutdown circuit operates and turns off power switch. When the junction temperature decreases lower than 150°C, the power switch is turned on due to hysteresis. This operation is repeated as long as the junction temperature continues increasing.

4. True reverse current blocking function(Option)

Some of these devices have built-in True reverse current blocking circuit (TRCB) to block reverse current from V_{OUT} to V_{IN} regardless of output MOSFET ON/OFF condition. (Full-Time Reverse Current Protection)

5. Under-voltage Lockout function(Option)

Some of these devices have a built-in Under-voltage Lockout Circuit to turn off switch if VIN drops below UVLO. This circuit has hysteresis and UVLO is released when VIN exceeds threshold.

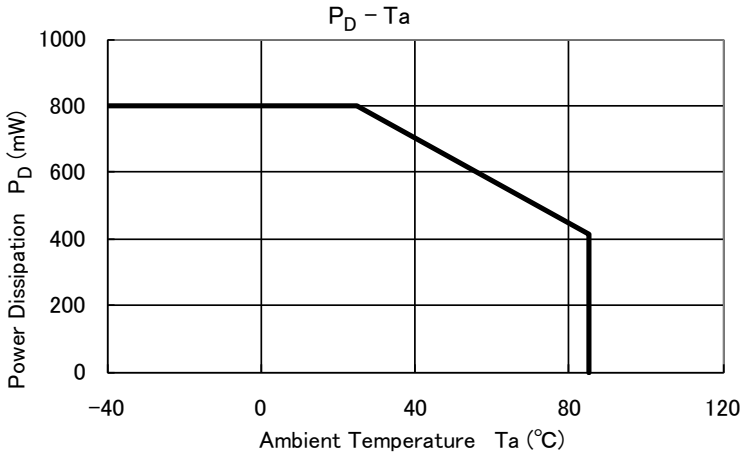
6. Instructions and directions for use

Each device has several built-in protection functions, but these does not assure for the suppression of uprising device operation. In use of these products, please read through and understand dissipation idea for absolute maximum ratings from the above mention or our ‘Semiconductor Reliability Handbook’. Then use these products under absolute maximum ratings in any condition. Furthermore, Toshiba recommend inserting failsafe system into the design.

7. Power Dissipation

Power dissipation is measured on the board condition shown below.

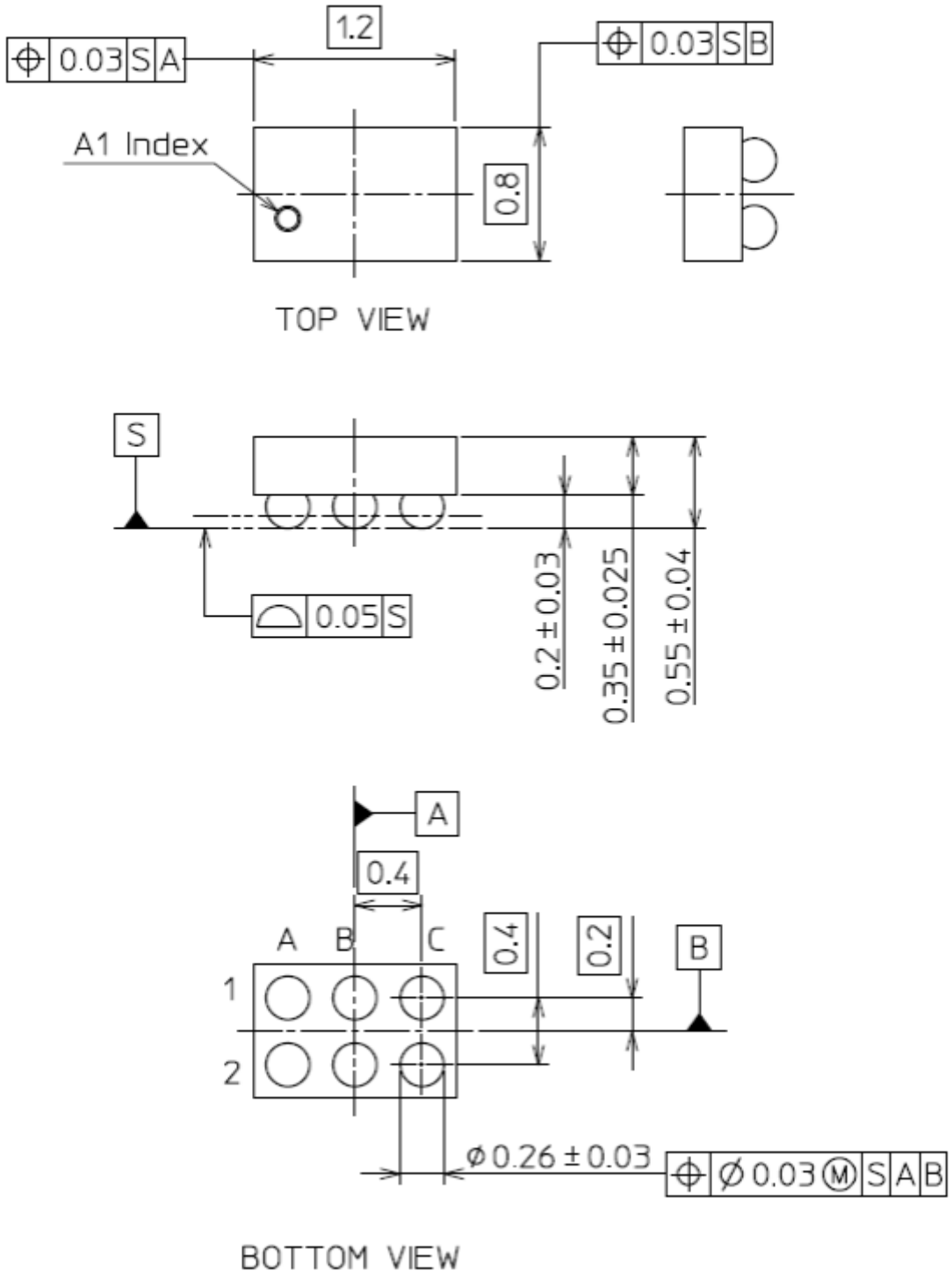
[The Board Condition]
Board material: Glass epoxy (FR4)
Board dimension: 40mm x 40mm (both sides of board), t=1.6mm
Metal pattern ratio: a surface approximately 50%, the reverse side approximately 50%
Through hole: diameter 0.5mm x 28



Please allow sufficient margin when designing a board pattern to fit the expected power dissipation. Also take into consideration the ambient temperature, input voltage, output current etc. and applying the appropriate derating for allowable power dissipation during operation.

Package dimension

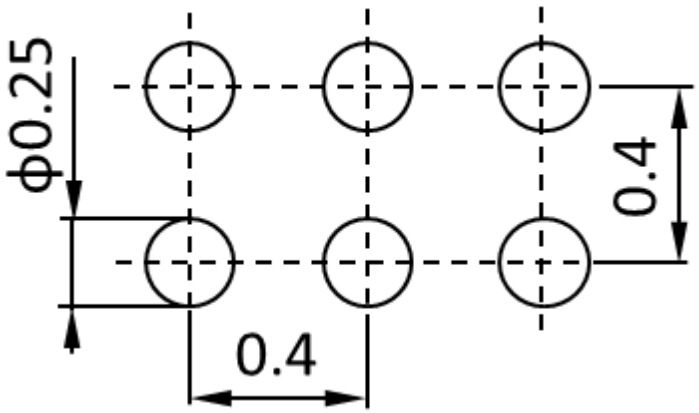
Unit: mm



Weight: 1 mg (typ.)

Land pattern dimensions (for reference only)

Unit: mm



RESTRICTIONS ON PRODUCT USE

Toshiba Corporation and its subsidiaries and affiliates are collectively referred to as “TOSHIBA”.
Hardware, software and systems described in this document are collectively referred to as “Product”.

- TOSHIBA reserves the right to make changes to the information in this document and related Product without notice.
- This document and any information herein may not be reproduced without prior written permission from TOSHIBA. Even with TOSHIBA's written permission, reproduction is permissible only if reproduction is without alteration/omission.
- Though TOSHIBA works continually to improve Product's quality and reliability, Product can malfunction or fail. Customers are responsible for complying with safety standards and for providing adequate designs and safeguards for their hardware, software and systems which minimize risk and avoid situations in which a malfunction or failure of Product could cause loss of human life, bodily injury or damage to property, including data loss or corruption. Before customers use the Product, create designs including the Product, or incorporate the Product into their own applications, customers must also refer to and comply with (a) the latest versions of all relevant TOSHIBA information, including without limitation, this document, the specifications, the data sheets and application notes for Product and the precautions and conditions set forth in the "TOSHIBA Semiconductor Reliability Handbook" and (b) the instructions for the application with which the Product will be used with or for. Customers are solely responsible for all aspects of their own product design or applications, including but not limited to (a) determining the appropriateness of the use of this Product in such design or applications; (b) evaluating and determining the applicability of any information contained in this document, or in charts, diagrams, programs, algorithms, sample application circuits, or any other referenced documents; and (c) validating all operating parameters for such designs and applications. **TOSHIBA ASSUMES NO LIABILITY FOR CUSTOMERS' PRODUCT DESIGN OR APPLICATIONS.**
- **PRODUCT IS NEITHER INTENDED NOR WARRANTED FOR USE IN EQUIPMENTS OR SYSTEMS THAT REQUIRE EXTRAORDINARILY HIGH LEVELS OF QUALITY AND/OR RELIABILITY, AND/OR A MALFUNCTION OR FAILURE OF WHICH MAY CAUSE LOSS OF HUMAN LIFE, BODILY INJURY, SERIOUS PROPERTY DAMAGE AND/OR SERIOUS PUBLIC IMPACT ("UNINTENDED USE").** Except for specific applications as expressly stated in this document, Unintended Use includes, without limitation, equipment used in nuclear facilities, equipment used in the aerospace industry, medical equipment, equipment used for automobiles, trains, ships and other transportation, traffic signaling equipment, equipment used to control combustions or explosions, safety devices, elevators and escalators, devices related to electric power, and equipment used in finance-related fields. **IF YOU USE PRODUCT FOR UNINTENDED USE, TOSHIBA ASSUMES NO LIABILITY FOR PRODUCT.** For details, please contact your TOSHIBA sales representative.
- Do not disassemble, analyze, reverse-engineer, alter, modify, translate or copy Product, whether in whole or in part.
- Product shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable laws or regulations.
- The information contained herein is presented only as guidance for Product use. No responsibility is assumed by TOSHIBA for any infringement of patents or any other intellectual property rights of third parties that may result from the use of Product. No license to any intellectual property right is granted by this document, whether express or implied, by estoppel or otherwise.
- **ABSENT A WRITTEN SIGNED AGREEMENT, EXCEPT AS PROVIDED IN THE RELEVANT TERMS AND CONDITIONS OF SALE FOR PRODUCT, AND TO THE MAXIMUM EXTENT ALLOWABLE BY LAW, TOSHIBA (1) ASSUMES NO LIABILITY WHATSOEVER, INCLUDING WITHOUT LIMITATION, INDIRECT, CONSEQUENTIAL, SPECIAL, OR INCIDENTAL DAMAGES OR LOSS, INCLUDING WITHOUT LIMITATION, LOSS OF PROFITS, LOSS OF OPPORTUNITIES, BUSINESS INTERRUPTION AND LOSS OF DATA, AND (2) DISCLAIMS ANY AND ALL EXPRESS OR IMPLIED WARRANTIES AND CONDITIONS RELATED TO SALE, USE OF PRODUCT, OR INFORMATION, INCLUDING WARRANTIES OR CONDITIONS OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, ACCURACY OF INFORMATION, OR NONINFRINGEMENT.**
- Do not use or otherwise make available Product or related software or technology for any military purposes, including without limitation, for the design, development, use, stockpiling or manufacturing of nuclear, chemical, or biological weapons or missile technology products (mass destruction weapons). Product and related software and technology may be controlled under the applicable export laws and regulations including, without limitation, the Japanese Foreign Exchange and Foreign Trade Law and the U.S. Export Administration Regulations. Export and re-export of Product or related software or technology are strictly prohibited except in compliance with all applicable export laws and regulations.
- Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. Please use Product in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. **TOSHIBA ASSUMES NO LIABILITY FOR DAMAGES OR LOSSES OCCURRING AS A RESULT OF NONCOMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS.**

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Toshiba:
TCK22946G,LF

LifeElectronics
Живое партнерство

ООО «ЛайфЭлектроникс» **“LifeElectronics” LLC**

ИНН 7805602321 КПП 780501001 Р/С 40702810122510004610 ФАКБ "АБСОЛЮТ БАНК" (ЗАО) в г.Санкт-Петербурге К/С 30101810900000000703 БИК 044030703

Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибьюторов Европы, Америки и Азии.

С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров

Мы предлагаем:

- *Конкурентоспособные цены и скидки постоянным клиентам.*
- *Специальные условия для постоянных клиентов.*
- *Подбор аналогов.*
- *Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.*

- *Приемлемые сроки поставки, возможна ускоренная поставка.*
- *Доставку товара в любую точку России и стран СНГ.*
- *Комплексную поставку.*
- *Работу по проектам и поставку образцов.*
- *Формирование склада под заказчика.*

- *Сертификаты соответствия на поставляемую продукцию (по желанию клиента).*
- *Тестирование поставляемой продукции.*
- *Поставку компонентов, требующих военную и космическую приемку.*
- *Входной контроль качества.*
- *Наличие сертификата ISO.*

В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- *Регистрацию проекта у производителя компонентов.*
- *Техническую поддержку проекта.*
- *Защиту от снятия компонента с производства.*
- *Оценку стоимости проекта по компонентам.*
- *Изготовление тестовой платы монтаж и пусконаладочные работы.*

Тел: +7 (812) 336 43 04 (многоканальный)
Email: org@lifeelectronics.ru

www.lifeelectronics.ru